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ABSTRACT

This final report presents a summary and second-year findings of a 2-year project designed to measure the effectiveness of microcomputer instruction on reading and mathematics skills, classroom behavior, general cognitive development, and problem-solving ability of 700 disabled students (ages 3-11) enrolled in four special education schools in New York State. Subjects were exposed to one of three treatment conditions (teacher-directed learning, instructional software, and LOGO) for three 30-minute periods per week over seven months. Analysis of pretest and posttest measures indicated that computer instruction, in the form of either LOGO or instructional software treatments, produced no significant effects related to the behavior, achievement, problem-solving ability, or general cognitive ability of handicapped students. (JW)

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The Impact of Microcomputer Instruction on Handicapped Students: Second Year Findings

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Despite the current interest in and emphasis on computer instruction in schools there has been little substantive research on the effectiveness of computers on cognitive and/or affective outcomes with normal or special populations.

The two-year project to be described is one of seven similar projects funded by the Research in Education of the Handicapped Technology Projects of the Office of Special Education and Rehabilitation Services of the U.S. Department of Education. The overall objectives of the project were to measure the effectiveness of microcomputer instruction on reading and mathematics skills, classroom behavior, general cognitive development, and problem-solving ability of students enrolled in four special education schools of a regional agency of the New York State Education Department.

The approximately 700 subjects of the study ranged in age from 3-11 years and had been classified as learning disabled, emotionally handicapped, speech impaired, neurologically impaired, mentally retarded, autistic, and multiply handicapped.

The original design called for a comparison of achievement of a computer instructed group with one engaged in teacher-directed activities (control), but because there is a widely held view that "without exceptions, the instructional software for current systems is uninteresting ..." (Budoff & Hutten, 1982, p. 123) an alternative treatment was sought with the inclusion of a second experimental condition, mediated Logo instruction.

> Papert has proposed using the microcomputer to allow the child to become a generative problem developer and problem solver. This approach has considerable potential for many special needs children. A major problem of many children with specific and global learning disabilities is their disordered approach to problems. The Logo

> program may be a particularly important tool for special needs children, though it currently tends to be used with competent problem-solving children. (Budoff & Hutten, 1982, p. 126).

A tentative hypothesis that, rather than the more generalized "computer instruction," Logo might be more suitable for some children and the regular instructional software beneficial to others was tested. Thus, there were three treatment conditions -- teacher-directed learning (control), instructional software (IS), and Logo.

Children were randomly assigned to the three groups within each school. They received instruction for three 30-minute periods each week in their school's Learning Center which housed Apple and Texas Instruments microcomputers. In the first year there were 120 preschool students (ages 3-5 years), 115 and 127 in each of two early elementary schools (5-8 years), and 196 in the upper elementary school (ages 8-11). During the second year the sample sizes were 136, 150, 162, and 222, respectively, as well as 45 in an elementary section of the preschool building.

Additional dependent variables were selected to reflect the modifications in the treatment conditions. It was suggested that the treatment effects resulting from Logo might be very different from those brought about by IS treatment. For example, a Logo intervention might facilitate the development of general thinking skills while having little impact upon specific reading or mathematics skills. Changes in children's behavior may be precursors of changes in cognitive functioning, and it was decided to investigate this variable as well as the longer-range objective of academic achievement.

Thus, dependent measures included reading and mathematics skills, classroom behavior of all pupils, and additionally for preschool

students, general cognitive development, and problem-solving ability. Adoption of multivariate dependent measures permitted a more comprehensive view of the ways in which particular treatments influence various learning outcomes.

At the end of the treatment period students were assessed by project staff and their classroom teachers. In the preschool, teachers tested children on selected subtests of the Brigance Diagnostic Inventory of Early Development and rated student behavior on the Classroom Behavior Inventory, Preschool Form (Schaefer & Edgerton, 1978). Project staff administered individually the Think It Through problem solving subtest of Circus.

Selected subtests of the Kaufman Assessment Battery for Children were administered to preschool students by project staff as follows:

3 Year Olds	4 Year Olds	5 Year Olds
Magic Window	Magic Window	Hand Movements
Face Recognition	Face Recognition	Triangles
Hand Movements	Hand Movements	Matrix Analogies
	Triangles	Spatial Memory

Elementary students were given appropriate levels of the Metropolitan Readiness Tests and Metropolitan Achievement Tests in reading and math by their classroom teachers, who rated students on the Classroom Behavior Inventory (Schaefer, Edgerton & Aaronson, 1978). The preschool level of the Schaefer measured eleven subscales: intelligence, curiosity/creativity, apathy, independence, dependence, task orientation, distractibility, considerateness, hostility, extraversion, and introversion. The elementary level included all except apathy.

Analyses of variance performed on first-year scores showed no significant differences due to treatment on any of the variables. It was believed that the necessarily short treatment period (three to four months) contributed in large measure to these results. In addition, the Learning Center staff who worked with the children had had little exposure to Logo and received rudimentary training from project staff.

During the second year the treatment period lasted seven months and more comprehensive Logo training was provided to Learning Center staff. Analysis of preschool data showed no significant main effects. Several sex and age differences appeared (see Table 1) which were unrelated to the research questions of this study. Several interactions of treatment and age were found (the three-year-olds in the Instructional Software condition were rated higher in Verbal Intelligence and Task Orientation and lower than the others on Distractibility and Hostility). These findings were probably more related to the characteristics of the students (N = 4) than the treatment.

For elementary pupils, analyses were performed by school, sex, handicapping condition, and block (prior academic achievement and computer experience). As may be seen in Table 2, the sole significant main effect was the rating of Introversion, where Logo students were significantly higher (more introverted) than the control group. Significant block effects were found, with the higher achieving blocks perceived as higher on desirable characteristics. Students in some handicapping conditions had higher scores than those with other classifications, and the schools serving older students had higher achievement and some higher behavior scores than the schools with younger

students. These findings, however, were unrelated to the questions under investigation. A treatment-block interaction was found (Block 4 IS was lowest in Hostility) and a treatment-handicapping condition (unclassified IS highest and autistic lowest on task orientation) but these, too, do not appear to have educational significance.

The overall finding in relation to the major research questions is that computer instruction, in the form of either Logo or Instructional Software treatments, has produced no significant effects related to the behavior, achievement, problem solving ability, or general cognitive ability of handicapped students.

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Table 1

Analysis of Variance Results for Preschool Sample (N = 129)

Variables	MAIN EFFECTS Treatment	Sex	HC	Age	INTERACTIONS
Schaefer Verbal Intelligence	-	-	-	-	T·A 3 yr. IS H
Introversion	-	-	-	-	-
Considerateness	-	-	-	-	-
Dependence	-	-	-	-	-
Task Orientation	-	-	Cells N = 0	-	T·A 3 yr. IS H
Apathy	-	-	Cells N = 0	-	-
Extraversion	-	-	-	-	-
Hostility	-	-	-	-	T·A 3 yr. IS L; Logo H
Creativity	-	-	-	-	T·S G Logo L; G IS H
Distractibility	-	-	-	-	T·A 3 yr. IS L
Independence	-	G> B	-	-	-
Brigance Speech & Language	-	B> G	-	-	-
General Knowledge & Comprehension	-	-	-	5> 4 > 3	-
Reading Readiness	-	-	-	5 > 4 > 3	-
Math	-	B > G	-	5> 4 > 3	-
Circus	-	-	-	-	-
Kaufman	-	-	-	-	-

Table 2

Analysis of Variance Results for Elementary Sample (N = 567)

Variables	Treatment	MAIN EFFECTS Block	Sex	HC	School	INTERACTIONS
Schaefer						
Extraversion	-	-	-	9< 1, 2, 3 4, 5, 6, 7, 8	3> 5	-
Creativity	-	S	B> G	9< 1, 3, 4	-	-
Distractibility	-	S	-	-	1, 2, 3	-
Independence	-	S	-	Sign. but Scheffe NS	3> 1, 3	-
Hostility	-	S	B> G	3> 2, 4, 7, 9	3> 5	T-B IS B 4 L
Verbal Intelligence	-	S	B> G	3> 7, 9	-	-
Task Orientation	-	S	-	-	3> 1	T-HC IS O=H, 9=L
Introversion	1> 3	-	-	Sign. but Scheffe NS	-	-
Considerateness	-	-	G> B	Sign. but Scheffe NS	-	-
Dependence	-	S	-	-	1> 3, 5	-
Metropolitan						
Reading	-	S	B> G	3> 2, 4, 5, 8, 9 1> 4	5< 1, 2, 3 3> 1, 2, 3	-
Math	-	S	B> G	3> 1, 2, 4 5, 7, 8 4< 1, 3, 8	3> 1, 2, 5 5< 1, 2, 3	-